

## SECTION 16111

### CONDUIT

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Conduit and fittings.

##### 1.2 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70—*National Electrical Code*.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purposes specified and shown.

##### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to prevent damage.
- B. Protect conduits from corrosion and entrance of debris.
- C. Protect PVC conduit from sunlight.

#### PART 2 PRODUCTS

\*\*\*\*\*  
**Edit 2.1 through 2.8 to match Project requirements.**  
\*\*\*\*\*

##### 2.1 INTERMEDIATE METAL CONDUIT AND FITTINGS

- A. Furnish galvanized intermediate metal conduit (IMC) that conforms to the requirements of UL1242—*Intermediate Metal Conduit*, ANSI C80.6—*Intermediate Metal Conduit*, and ANSI/NFPA 70, Article 345.
- B. For intermediate metal conduit, furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that conform to the requirements of UL514B—*Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1—*Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*.

##### 2.2 RIGID GALVANIZED STEEL CONDUIT AND FITTINGS

- A. Furnish rigid galvanized steel conduit (RGS) that conforms to the requirements of UL6—*Rigid Metal Electrical Conduit*, ANSI C80.1—*Rigid Steel Conduit, Zinc Coated*, and ANSI/NFPA 70, Article 346.
- B. For rigid galvanized steel conduit, furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that conform to the requirements of UL514B and ANSI/NEMA FB1.

##### 2.3 PLASTIC-COATED STEEL CONDUIT AND FITTINGS

- A. Furnish PVC exterior coated, urethane interior coated, galvanized rigid steel conduit or intermediate metal conduit that conforms to the requirements of NEMA RN 1—*PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit*.
- B. Provide factory-fabricated elbows for sizes 2 inches and larger.

- C. For plastic-coated steel conduit, furnish 40 mil PVC exterior coated, urethane interior coated, zinc-plated, threaded, malleable iron fittings and conduit bodies that conform to the requirements of UL514B—*Fittings for Conduit and Outlet Boxes* and NEMA RN 1—*PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit*.

## 2.4 RIGID NON-METALLIC CONDUIT AND FITTINGS

- A. Furnish rigid non-metallic conduit (PVC) that conforms to the requirements of UL651—*Schedule 40 and 80 Rigid PVC Conduit*, NEMA TC 2—*Electrical Plastic Tubing and Conduit*, ANSI C80.3, and NFPA 70, Article 347.
- B. For rigid non-metallic conduit, furnish non-metallic, solvent-welded socket fittings that conform to the requirements of UL514C—*Non-Metallic Fittings for Conduit and Outlet Boxes*, and NEMA TC 3—*PVC Fittings for Use with Rigid PVC Conduit and Tubing*.

## 2.5 ELECTRICAL METALLIC TUBING AND FITTINGS

- A. Furnish galvanized electrical metallic tubing (EMT) that conforms to the requirements of UL797—*Electrical Metallic Tubing*, ANSI C80.3, and NFPA-70, Article 348.
- B. For EMT, furnish concrete-tight, zinc-plated steel or zinc-plated malleable iron fittings that conform to the requirements of UL514B—*Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1—*Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

## 2.6 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish galvanized steel flexible metal conduit that conforms to the requirements of UL1—*Flexible Metal Electrical Conduit* and NFPA-70, Article 350.
- B. For flexible metal conduit, furnish zinc-plated malleable iron fittings that conform to the requirements of UL514B—*Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1—*Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

## 2.7 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish liquid-tight flexible metal conduit that conforms to the requirements of UL360—*Liquid-Tight Flexible Steel Conduit, Electrical* and NFPA-70, Article 351.
- B. For liquid-tight flexible metal conduit, furnish zinc-plated malleable iron or zinc-plated steel liquid-tight fittings that conform to the requirements of UL514B—*Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1—*Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

\*\*\*\*\*  
**Edit 2.8 to match project requirements. Use rigid aluminum conduit only for 400 Hz power circuits and similar specialized applications.**  
\*\*\*\*\*

## 2.8 RIGID ALUMINUM CONDUIT AND FITTINGS

- A. Furnish rigid aluminum conduit that conforms to the requirements of UL6—*Rigid Metal Electrical Conduit*, ANSI C80.5, and NFPA-70, Article 346.
- B. For rigid aluminum conduit, furnish threaded aluminum fittings and conduit bodies that conform to the requirements of UL514B, *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1—*Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*.

## 2.9 INSULATING BUSHINGS

A. Provide UL listed insulating bushings with 105 °C rated insulation.

B. Manufacturer: O-Z/Gedney, Type IB.

## 2.10 GROUNDING BUSHINGS

A. Provide UL listed, galvanized malleable iron, 150°C rated insulated throat grounding bushings with lay-in type ground cable lugs.

B. Manufacturer: O-Z/Gedney, Type BLG.

\*\*\*\*\*  
**Edit 2.11 to match project requirements.**  
\*\*\*\*\*

## 2.11 EXPANSION FITTINGS

A. Furnish UL listed expansion fittings with hot dipped galvanized malleable iron body, factory installed packing and a bonding jumper.

B. Manufacturer: O-Z/Gedney, Type AX, TX or EXE with Type BJ bonding jumper.

\*\*\*\*\*  
**Edit 2.12 to match project requirements.**  
\*\*\*\*\*

## 2.12 SEALING FITTINGS

A. Furnish zinc-plated, malleable iron sealing fittings that conform to the requirements of UL886, *Outlet Boxes and Fittings for Use in Hazardous Locations* and NFPA-70, Articles 500-503.

B. Manufacturer: O-Z/Gedney, Type EYA, EY or EZS.

\*\*\*\*\*  
**Edit 2.13 to match project requirements.**  
\*\*\*\*\*

## 2.13 SMOKE AND FIRE STOP FITTINGS

A. Furnish UL listed, 3 hour rated smoke and fire stop fittings designed for placement around rigid steel conduit, intermediate metal conduit or electrical metallic tubing passing through core-drilled or cast-in-place holes in concrete floors or walls.

B. Manufacturer: O-Z/Gedney, Type CFS.

## 2.14 SMOKE AND FIRE SEALANT

\*\*\*\*\*  
**Edit 2.14 to match project requirements. Use paragraph A if Section 07270 - FIRESTOPPING is included in the project specifications.**  
\*\*\*\*\*

A. Refer to Section 07270 - FIRESTOPPING for smoke and fire sealant products.

\*\*\*\*\*  
**Use paragraphs B and C if there is no FIRESTOPPING specification section.**  
\*\*\*\*\*

- B. Provide smoke sealant and fire barrier latex caulk that has intumescent and endothermic properties and has UL Classified system ratings of up to four hours.
- C. Manufacturer: 3M, type CP 25WB+ Caulk

## 2.15 CORROSION PROTECTION TAPE

- A. Furnish pressure-sensitive, 10 mil thick. PVC based tape for corrosion protection of metal conduit and fittings..
- B. Manufacturer: 3M, Type 50.

## 2.16 CONDUIT MEASURING TAPE

- A. Furnish conduit measuring tape with permanently printed measurements in one-foot increments.
- B. Manufacturer: Greenlee "GR435".

# PART 3 EXECUTION

## 3.1 EXAMINATION

Examine surfaces to receive conduits for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 GENERAL

- A. Conduit termination points shown on the Drawings are in approximate locations unless dimensioned. Verify termination locations of conduits before rough-in.
- B. Conduit routing is shown on the Drawings in approximate locations unless dimensioned. Coordinate routing of conduits with structure and with work of other trades. Route conduits as required for a complete wiring system.
- C. Use minimum 3/4 inch conduit except as follows:
  1. 1/2 inch conduit may be used for 20 ampere lighting and general purpose receptacle branch circuits.
  2. 1/2 inch conduit may be used for connections to control and instrument devices
  3. 3/8 inch flexible metal conduit in 6 foot maximum lengths may be used for tap conductors to lighting fixtures above suspended ceilings.

## 3.3 CONDUIT SUPPORTS

\*\*\*\*\*

**If Specification does not include Section 16190, Electrical Supporting Devices, delete A.**

\*\*\*\*\*

- A. Support conduit in accordance with the requirements of Section 16190, Electrical Supporting Devices.

\*\*\*\*\*

**If Specification includes Section 16190, Electrical Supporting Devices, delete B, C and D.**

\*\*\*\*\*

- B. Support conduit using zinc-plated steel or zinc-plated malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Group related conduits; support using trapeze hangers. Construct trapeze hangers using steel channel and threaded rods. In new construction, provide space on each trapeze hanger for 25% additional conduits.
- D. Attach conduit supports and hangers using the following methods:
  - 1. Use toggle bolts on dry wall or hollow masonry units.
  - 2. Use wood screws on wood.
  - 3. Use expansion bolts on concrete or solid masonry.
  - 4. Use beam clamps on structural steel.
  - 5. Use sheetmetal screws on sheetmetal.
- E. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

### 3.4 CONDUIT INSTALLATION

- A. Install conduit and fittings according to NFPA 70 and the following wiring methods schedule:

\*\*\*\*\*  
**Edit 1 and 2 to match project requirements.**  
 \*\*\*\*\*

- 1. Outdoors:
  - a. Exposed: Use rigid galvanized steel conduit or intermediate metal conduit for exposed outdoor work.
  - b. Concealed: Use rigid galvanized steel conduit or intermediate metal conduit for concealed outdoor work. Do not use rigid galvanized steel conduit or intermediate metal conduit in direct contact with earth.
  - c. Underground, Direct Buried: Use rigid non-metallic conduit, plastic-coated rigid steel conduit, tape-wrapped rigid steel conduit, or tape-wrapped intermediate metal conduit for direct buried underground work. Do not use rigid non-metallic conduit where subject to physical damage. Install with 24 inches minimum cover to finished grade or paving.
  - d. Underground, Concrete Encased: Use rigid non-metallic conduit, plastic-coated rigid steel conduit, rigid galvanized steel conduit or intermediate metal conduit for concrete encased underground work. Install with 24 inches minimum cover to finished grade or paving.
  - e. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Use liquidtight flexible metal conduit for connections to vibrating exterior equipment.
  - f. Corrosive Locations (including cooling towers): Use plastic-coated rigid steel conduit for work in corrosive exterior locations.
- 2. Indoors:

- a. Exposed Dry Locations: Use electrical metallic tubing (EMT), 2 inch trade size and smaller, for exposed indoor work where not subject to physical damage during or after installation. Use rigid galvanized steel conduit or intermediate metal conduit for exposed indoor work subject to physical damage.
  - b. Concealed Dry Locations: Use electrical metallic tubing, 2 inch trade size and smaller, rigid galvanized steel conduit or intermediate metal conduit for concealed indoor work.
  - c. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Use flexible metal conduit for connections to vibrating equipment in dry indoor locations. Use liquidtight flexible metal conduit for connections to vibrating equipment in wet or damp indoor locations and in mechanical rooms .
  - d. Damp or Wet Locations: Use rigid galvanized steel conduit or intermediate metal conduit for work in indoor wet or damp locations.
  - e. Corrosive Locations: Use plastic-coated rigid steel conduit or non-metallic conduit (PVC) for work in corrosive indoor locations.
- B. Conceal conduits, unless otherwise indicated on the Drawings, within finished walls, floors and ceilings. Run concealed conduits with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated on the Drawings.
- C. Install conduits embedded in concrete slabs or walls in the middle third of the slab thickness where practical, and leave at least 1 inch concrete cover.
1. Secure conduits to reinforcing rods to prevent sagging, shifting or floating during concrete placement.
  2. Space conduits laterally to prevent voids in the concrete.
  3. Do not install conduits larger than 1-inch trade size in concrete walls or slabs.
  4. Transition nonmetallic conduit to Schedule 80 nonmetallic conduit, tape-wrapped rigid steel conduit, tape-wrapped IMC, or plastic coated rigid steel conduit before rising above slabs.
- D. Install exposed conduits parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
1. Run parallel or banked conduits together, on common supports where practical.
  2. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
  3. Use conduit bodies to make sharp changes in direction, as around beams.
  4. Arrange conduits to maintain headroom.
- E. Join and terminate conduits with fittings designed and approved for the purpose.
1. Make-up metallic fittings wrench tight.
  2. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

3. Use insulating bushings or connectors with an insulated throat to protect conductors.
4. Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
5. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
6. Use threaded hubs or sealing locknuts to fasten conduits to boxes in exterior, damp or wet locations.
7. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduits dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

F. Stub-Up Connections:

1. Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor or equipment pad.
2. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor.
3. Where equipment connections are not made under this Contract, install threaded flush plugs flush with the floor.

G. Flexible Connections:

\*\*\*\*\*

**Edit paragraph 1 to match project requirements; delete on projects with manufactured wiring systems.**

\*\*\*\*\*

1. Use 3/8" flexible metal conduit in 6'-0" lengths of to connect light fixtures recessed in suspended ceilings to outlet boxes.
2. Connect equipment subject to vibration, noise transmission, or movement, and all motors using a minimum of 18 inches and maximum of 3 feet length flexible conduit.]

\*\*\*\*\*

**Edit paragraph H to match project requirements.**

\*\*\*\*\*

- H. Install conduit sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed conduit sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
1. Where conduits enter or leave ANSI/NFPA 70 Class I hazardous locations.
  2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.

3. Where conduits enter or leave radiological "controlled areas."
4. Where otherwise required by ANSI/NFPA 70.

\*\*\*\*\*

**Edit paragraph I to match project requirements.**

\*\*\*\*\*

- I. Install plastic-coated rigid steel conduit and fittings according to NFPA 70 and manufacturer's instructions. Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
- J. Do not use non-metallic conduit (PVC) 90 degree elbows larger than 2 inch trade size; use plastic-coated steel, tape-wrapped rigid steel conduit, or tape-wrapped intermediate metal conduit for 2-1/2 inch trade size and larger 90 degree elbows.
- K. Do not use EMT larger than 2 inch trade size.

\*\*\*\*\*

**Edit paragraph L to match project requirements. Use rigid aluminum conduit only for 400 Hz power circuits and similar specialized applications.**

\*\*\*\*\*

- L. Use rigid aluminum conduit only as indicated on the Drawings [for 400 Hz power circuits]. Install rigid aluminum conduit and fittings according to NFPA 70, Article 346. Do not install rigid aluminum conduit in direct contact with earth or concrete. Where rigid aluminum conduit passes through concrete, install in a nonmetallic sleeve.
- M. Maintain the following minimum inch clearances between conduit and surfaces with temperatures exceeding 104° F (40° C):
  1. 3" at perpendicular crossings.
  2. 6" between parallel runs.
- N. Avoid moisture traps in conduit system; provide junction boxes with drain fitting at low points in conduit system.
- O. Install expansion fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints.
- P. Use suitable caps to protect installed conduits against entrance of dirt and moisture.
- Q. Install corrosion protection tape on metal conduits and fittings using half-lapped wrappings.
- R. Install grounding bushings at the following locations:
  1. At every entry to enclosures on metallic conduits containing circuits rated 100 amperes and higher.
  2. On metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
  3. On metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
  4. Ground and bond conduits under provisions of Section 16450.

- S. Install conduit measuring tape in empty raceways. Leave not less than 12 inches of slack at each end of the tape. Secure each end of tape.
- T. Telephone and Signal System Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

\*\*\*\*\*

**Edit 3.5 to match project requirements.**

\*\*\*\*\*

### 3.5 FIRESTOP INSTALLATION

- A. Install fire and smoke stop fittings at single electrical conduit penetrations through core-drilled openings in fire-rated concrete walls and floors. Install following manufacturer's instructions to restore original fire rating.
- B. Install smoke and fire sealant caulk at conduit penetrations through openings in fire rated walls, floors and partitions. Install in accordance with manufacturer's instructions to restore original fire rating.
- C. Request inspection of firestop installations by the LANL Authority Having Jurisdiction both before and after installation of firestop materials.

### 3.6 CONDUIT IDENTIFICATION

- A. Mark and identify conduits as required in Section 16195 - ELECTRICAL IDENTIFICATION.

END OF SECTION